# The NORTH QUEENSLAND NATURALIST

## CAIRNS

Journal of

NORTH QUEENSLAND NATURALISTS CLUB
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55th YEAR No.186 MARCH, 1987


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# PRODUCTION OF SONAR CLICKS BY GREY SWIFTLETS

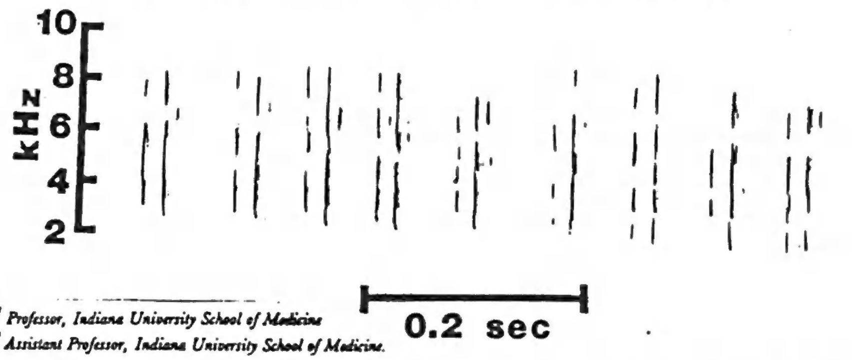
Rod Suthers[1] and Dwight Hector[2]

The grey swiftlets ( Collocalia spodiopygia) which breed in some of the Chillagoe caves are of considerable scientific interest. Like other swiftlets they are highly visual birds which spend most of their lives on the wing depending on their eyes to locate and catch small insects. The ability to use dark caves as safe refuges, in which to breed, has required that their almost exclusive dependence on visual orientation outside the cave be replaced with nearly total dependence on acoustic orientation inside the cave. The grey swiftlets and several other species of Collocalia as well as the much larger frugivorous oilbirds (Steatornis) in tropical America are thus unique among birds in having evolved an ability to echolocate in a manner basically similar to many bats.

The signals which these birds use for echolocation however, are broadband clicks which are cleary audible to the human ear, and are thus very different from the ultrasonic tone bursts and frequency sweeps generated by nearly all echolocating bats. When these swiftlets sonar clicks are tape recorded and the recording is played back at a greatly reduced speed it becomes evident that what sounds like a single click typically consists of two successive clicks or bursts of sound each lasting several milliseconds and separated from each other by a silent intraclick interval lasting about 25 milliseconds (Fig. 1). Most of the acoustic energy in these double clicks lies between about 2 and 8 kHz.

Our research on swiftlets at Chillagoe had as its goal a better understanding of this unique sonar system. We wanted to know how these birds were adapted for the use of acoustic orientation, how sophisticated their sonar system was,what sorts of objects they could detect by echolocation and how they produced their sonar signals. We were particularly interested in this last aspect of swiftlet echolocation because in order to understand an animal's sonar system it is necessary to know something about the way in which the sonar transmitter functions as well as about the capabilities of the sonar receiver, which in this case consists of the ear and auditory system. Furthermore, a study of swiftlets, which have a relativly simple vocal apparatus, might shed light on some of the unresolved problems regarding the acoustics and physiology of bird song in general. Thus some members of our expedition tested the sensitivity of the swiftlets echolocation using behavioral tests of obstacle avoidance, others used neurophysiological techniques to study the way in which nerve cells in the auditory system respond to sound, and we investigated the mechanism by which the click-like sonar signals are produced.

*FIG. 1. Sonogram of nine normal double clicks. The scale at left indicates sound frequency in kilohertz (kHz). Note that each click contains sound frequencies ranging from about 2 to 8 kHz. Click repetition rate in this series is about 15 per second.*




In the case of mammals, including echolocating bats, vocalizations are produced in the larynx. In birds however,the organ of sound production is the syrinx which is located at or near the junction of the two primary bronchi where they join to form the trachea. The click-like sounds of the swiftlets are quite different from most other avian vocalizations, however, and previous investigators had postulated that they might be produced at some other structure such as the beak, the tongue, or in some other part of the airway. Experiments by Dr. Dermot Smyth, now with the C.S.I.R.O. ruled out the beak and tongue as the source of the clicks,but had not resolved the possible role of the syrinx. We were able to show that airflow through the syrinx is necessary for click production and verify that the clicks are indeed generated in the syrinx.

The syrinx in swiftlets consists of a cartilaginous Y-shaped tube-like structure containing two pairs of membranes, the external and internal tympaniform membranes (Fig. 2). Unlike the syrinx of song birds, that of swiftlets has no intrinsic muscles. Rather the external forces on the trachea are mediated by two pairs of tracheal muscles, the tracheolateralis muscles which run from the caudal end of the trachea to a point near the sternum. Both of these muscles are innervated by branches of one of the cranial nerves, the hypoglossal nerve. The anatomical arrangement of these muscles makes it clear that they have apposing actions on the trachea and indirectly, on the syrinx. Contraction of the tracheolateralis muscles shortens the trachea. In doing so it pulls on the cranial end of the syrinx and draws the syrinx towards the head. The sternotrachealis muscles however, has the opposite effect since they attach just anterior to the syrinx and run posteriorly. Contraction of these muscles stretches the trachea by pulling it posteriorly and in doing so reduces the tension exerted on the syrinx by the trachea.

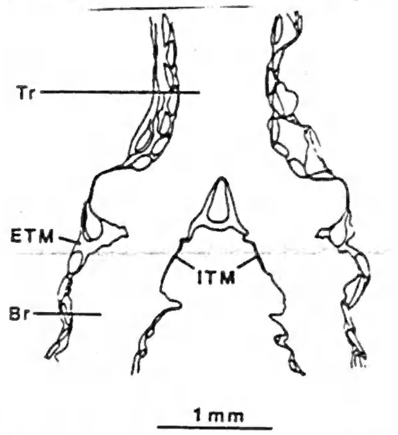



*FIG. 2 Drawing of a longitudinally cut swiftlet syrinx attached to trachea (Tr) above and primary bronchi (Br) below. ETM, external tympaniform membrane; ITM, internal tympaniform membrane. Muscles are not shown in this drawing.*

In the absence of any intrinsic syringeal muscles it seemed probable that these two pairs of tracheal muscles may play an important role in the generation of the sonar clicks. In order to test this hypothesis it was necessary to determine if the activity of these two muscles was correlated with click production. The contraction of muscles is associated with the presence of small electrical potentials which pass over the membrane of the muscle cell. These electrical signals are referred to as an electromyogram or E M G. In order to record the E M G of the swiftlet's tracheal muscles we anesthetized the bird and implanted the tips of extremely fine (.001 inch diameter) wire electrodes in the body of the muscles. The small surgical incision that was necessary to do this was then closed. The fine wires were soldered to larger wires which were anchored to the birds tail feathers, from which they formed a short tether, before going to an amplifier and tape recorder. We were greatly aided in our research by the fact that swiftlets would produce their echolocating clicks when allowed to hover on the end of a short tether in front of a microphone in a dark chamber. The E M G was then recorded on one channel and the clicks were recorded on another channel of the tape recorder, while the bird hovered on its tether in front of the microphone. After several attempts at perfecting this technique, we succeeded in getting good recordings of muscle activity along with the clicks produced by the hovering bird. These records showed that the sternotrachealis muscle begin to contract about 20 milliseconds before the onset of the click, and that its electrical activity ends during the time corresponding to the silent period between the two members of the double click (Fig3). The tracheolateralis muscles, on the other hand, did not begin to contract until after the first member of the double click was emitted. Their E M G thus began during the silent period and continued until shortly after the end of the second member of the double click.

This information on the activity of these muscles was an important first step in our study of the production of the sonar clicks. In order to understand their functional role, we needed to know how they effected airflow through the syrinx. Data on airflow were obtained by implanting a small stainless steel tube or cannula into the bird's trachea. In the centre of this tube we had mounted a microbead thermister ( .005 inch diameter) which was heated to a constant temperature. During inspiration and expiration the air flowing through the trachea tended to cool the thermister. The electronic control circuitry to which the thermister was attached measured the amount of current needed to maintain the thermister at a constant temperature. By measuring the current flowing through the thermister at known rates of airflow it was possible to calibrate the thermister so that it provided an accurate measure of tracheal airflow. In addition to the thermister, a short sidearm of the tracheal cannula contained a miniature piezoresistive pressure transducer. In these experiments tracheal airflow, tracheal air pressure, and the sonar clicks were all recorded on separate channels of our tape recorder while the bird hovered in front of a microphone. Often a second pressure transducer was inserted into one of the air sacs of the respiratory system, thus providing a measure of the air

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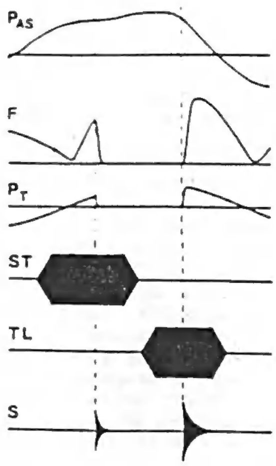


*FIG. 3 Schematic summary of temporal relationships during one normal double click. F = rate of tracheal airflow; $P_T$ = tracheal pressure; $P_{AS}$ = sternal air sac pressure, ST = EMG of sternotrachealis muscle; S = double click. EMG and sound wave forms are not shown, only their relative intensity and duration are illustrated in solid black.*

pressure in the air sacs, lungs, and bronchi below the syrinx. When we analyzed these tape recorded data (Fig3) we found that prior to click production the pressures in the air sac and trachea begin to rise and the previously inspired air begins to flow out through the trachea as expiration begins. Expiration does not continue uninterrupted however, if a sonar click is to be produced during that respiratory cycle. The first member of the double click is accompanied by an abrupt cessation of airflow through the trachea, even though the subsyringeal pressures remain high. During the silent interval between the members of the double click no air flows through the trachea. The second member of the double click is produced as air again begins to flow out through the trachea. Expiration continues after the end of the second click and the positive subsyringeal pressure decreases as the remaining air is expelled. The subsequent inspiration is of course accompanied by a negative air sac pressure. These data clearly indicate that the syrinx is acting as a valve which shuts off expiratory airflow at the time of the first member of the double click and then opens, allowing expiratory airflow to resume, at the time of the second member of the double click.

When these data on the dynamics of airflow are combined with those obtained from electromyography, and with a careful anatomical study of the syrinx, we can begin to understand how swiftlets produce their sonar clicks(Fig4). The first step in click production involves the contraction of the sternotrachealis muscles, which reduces the tension across the syrinx, and allows one of the bronchial cartilages to rotate inward. This moves a structure called the external tympaniform membrane into the lumen and closes the airway. As the aperature of the lumen is narrowed, the rate of airflow increases. At a critical point just before the lumen is completely occluded, we believe this high rate of airflow through the restricted aperature creates Bernoulli forces which cause the internal tympaniform membranes to vibrate producing the first member of the double click(Fig.4B). This vibration is terminated after a few milliseconds by closure of the lumen (Fig.4C). The sternotrachealis muscles then relax as the tracheolateralis muscles begin to contract. By shortening the trachea the tracheolateralis muscles stretch the syrinx and cause the external tympaniform membranes to rotate outward, thus opening the syringeal lumen and allowing airflow to resume. The high subsyringeal pressure, which is sustained during the intraclick interval by the expiratory effort against a closed syrinx causes an initially high rate of airflow through the restricted syringeal lumen as the external tympaniform membranes start to retract. This high rate of airflow again causes a brief vibration of the internal tympaniform membranes resulting in the second member of the click pair (Fig.4D). As the outward member of the external tympaniform membranes continues, the syringeal lumen becomes larger and the velocity of airflow decreases, thus terminating the vibration of the internal tympeniform membranes and ending the second member of the click pair. The antagonistic actions of the two pairs of tracheal muscles are therefore responsible for rapidly closing and opening the syrinx during expiration, thus generating the double click.

It is interesting to speculate on why an echolocating bird, such as a swiftlet, should produce a double click instead of a longer duration, single click or squeak-like sound for its sonar pulse. There are several reasons why two brief click-like sounds may be better for echolocation than one longer squeak. Radar theory has shown that many kinds of information such as the target range and direction can be better carried in signals which have a wide band width or contain a wide range of frequencies than in signals containing a very narrow range of frequencies. By making two brief click-like sounds the swiftlets must substantially increase the bandwidth of their sonar signal compared to a single longer duration squeak.Another advantage of clicks lies in the fact that by their brief nature they typically have a very abrupt onset and termination. Since swiftlets presumably measure the distance of a target by the time lapse between the emission of a click and the return of its echo, signals with an abrupt onset and termination generally lend themselves better to temporal measurements of this sort than do signals which gradually increase and decrease in amplitude.

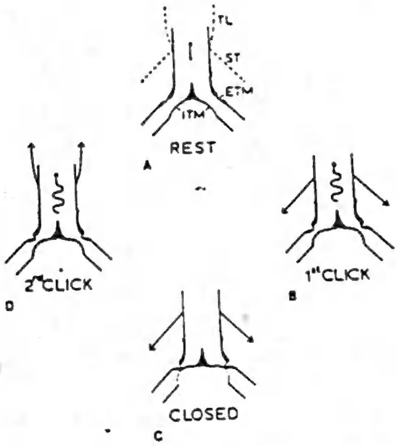


*FIG. 4. Diagram of the swiftlet syrinx and tracheal muscles showing the cycle of events responsible for producing a normal double click. Airflow is indicated by arrow in trachea. See text for explanation. ETM = external tympaniform membrane; ITM = internal tympaniform membrane; ST = sternotrachealis muscle; TL = tracheolateralis muscle.*

ACKNOWLEDGEMENTS

We wish to express our gratitude to Thomas Robinson of Cairns, and the Chillagoe Caving Club and the staff of the Queensland National Parks and Wildlife Service for their essential assistance in arranging the field research. This was conducted on the 1980 Chillagoe Expedition to Australia and was supported by National Science Foundation grant numbers B N S 79-13968 and B N S 79-05606 to Indiana University.

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## BANDING BIRDS OF PREY

By Tom Aumann

During the period between 15 May and 31 July, 1986, I operated 8 falling lid Swedish Goshawk Traps in the Kuranda area under permits and issued by the Queensland National Parks and Wildlife Service,and Under Banding Licence 902 A.
The traps were set in the area west of Kuranda, bounded by the Clohesy River, Myola Rd., and Speewah/Stoney Creek Rd.. All traps were placed on private property. Properties concerned were owned or managed by Mess'rs McDougal, Mullins, Matson, Armstrong, Dyer, Elgar, Watt, Pavlo, and Murray.

Birds banded during the period were:

| | |
|---|---|
| Black Kite ( Milvus migrans)........................................ | 1 |
| Brown Goshawk ( Accipiter fasciatus)........................................ | 14 |
| Collared Sparrowhawk ( A.cirrhocephalus)........................................ | 5 |
| Grey Goshawk ( A.novaehollandiae)........................................ | 6 |
| Little Eagle ( Hieraeetus morphnoides)........................................ | 1 |
| Spotted Harrier ( Circus assimilis)........................................ | 1 |
| Brown Falcon ( Falco berigora)........................................ | 3 |
| Australian Kestrel ( F. cenchroides)........................................ | 1 |
| Total.............. | 32 |

All birds were banded and released after taking morphological data at the capture location, with the exception of two individuals released some distance away at the request of the relevant property owners ( each of whom reported losses or harassment of their domestic birds).

Three of the birds listed above were banded and released from the " Wildworld" fauna park. These, a Black Kite,an Australian Kestrel,and a Brown Goshawk, had been handed in to the park authorites, presumably in a destressed state. All were in good condition at banding release.

All details concerning banded birds have been forwarded to the Australian Bird-Banding Scheme in the usual way.

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## ATHERTON BASALTS

By Les Francis

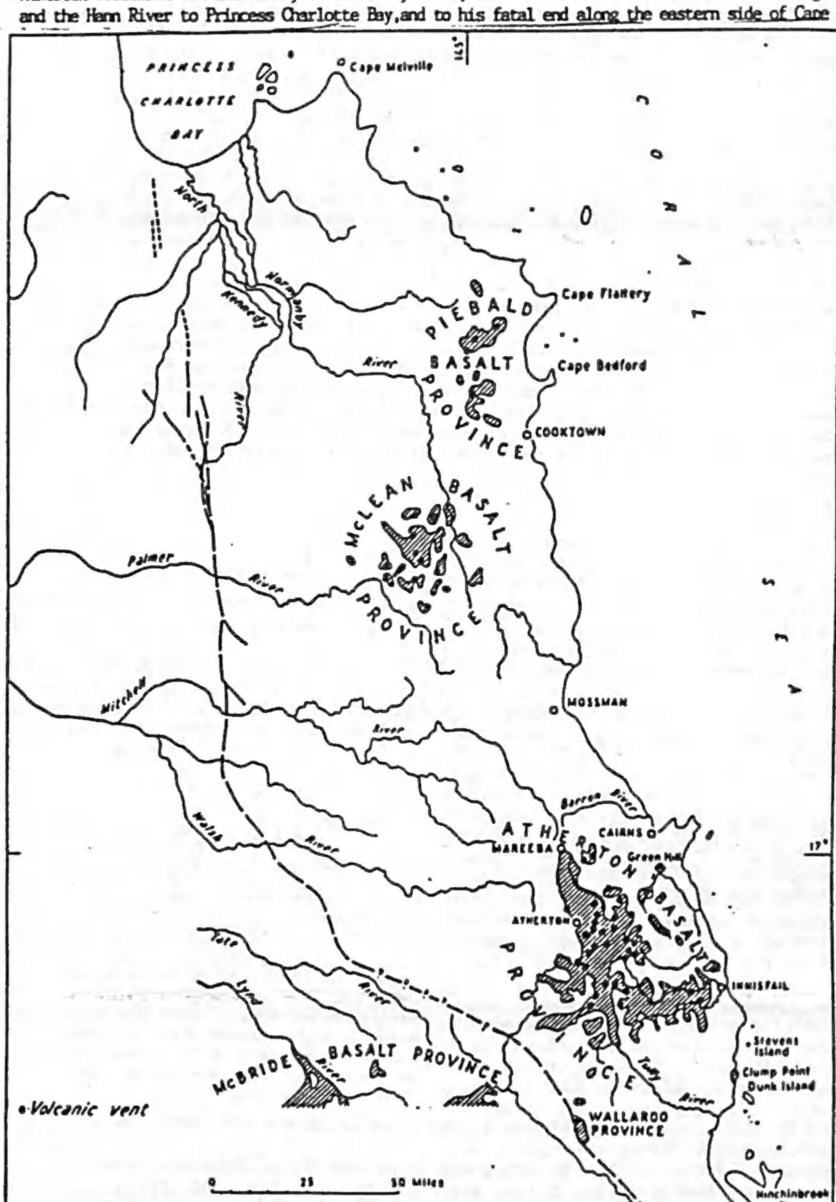
What I will discuss is the volcanics of the Atherton Tablelands known as the Atherton Province. This consists principally of a potash-rich olivine basalt-that is, a basalt of magnesium silicate ($Mg_2SiO_4$) and iron silicate ($Fe_2SiO_4$). This article will cover such features as the crater lakes (maars), the Seven Sisters, Mt. Quincan, Mt. Hypipamee, Green Hill and the Palmerville Fault.

Although this article is about geology, I will start by discussing the early explorers.

The western and northern slopes of Cape York Peninsula were among the first parts of Australia to be sighted and reconnoitred by Spanish, Portuguese and Dutch navigators during the 17th and 18th centuries. The first exploration in this region was carried out by James Cook who in 1770 described and named sections of the east coast, and made landings at Yarrabah, Cooktown, Lookout Point, Lizard Island and a few coral cays further north.

Between 1815 and 1870 several Royal Navy surveys were conducted but land surveys began when Leichhardt in 1845, skirted the south-western part of the Tablelands and reported enthusiastically on the fine pastures along the Burdekin River. Confirmation from Gregory and Dalrymple caused the land to be made available to settlement.

Three years after Leichhardt's expedition, Kennedy crossed the area from Cardwell to Princess Charlotte Bay. Kennedy obtained access to the Atherton Tableland via the valley of the Tully River,and then travelled northwest down the Hodgkinson and Mitchell Rivers,thenvia Mt. Mulgrave and the Hann River to Princess Charlotte Bay,and to his fatal end along the eastern side of Cape York.




The basalt provinces in northeastern Queensland.

The Hann expedition of 1872 was most successful. Hann crossed the Tate, Walsh, Mitchell and Palmer Rivers,west of the Palmerville fault, and he discovered traces of gold in the Palmer River which led to the opening up and development of the country. Hann had in his company a geologist, Norman Taylor, who recorded the ages of some of the basalts south-east of Mt. Mulgrave and the mica schist's country of the Mitchell Palmer area.

Daintree prepared the first geological map of the Colony of Queensland and showed only the southern coastal part as mainly granitic in the east and volcanic in the west for the area we are considering.

Jack ( of Jack and Newells) reported between 1879 and 1907 on nearly every mining centre in the area.

Twenty years after Daintree's partly blank and generalised map was published new information was embodied in " The Geology and Paleontology of Queensland and New Guinea" by Jack and Etheridge, 1892.

In 1923 Jensen revised the geology of Cairns and was much more comprehensive concerning the Barron River Metamorphics.

The first Aerial Survey was undertaken from 1937 to 1942. The results were unpublished due to World War 2 but the information gained was used in a paper issued in 1964.

The Bureau of Mineral Resources began a systematic programme in 1956.

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The average altitude of the Atherton Tableland ranges from 2600 feet in the south to 2300 feet in the north. Most of its northern and central parts are covered by late Cainozoic basaltic flows and pyroclasts which filled the depressions in the old land surface,so that the topography now varies from flat in the north to undulating in the centre. Several prominent hills represent old basaltic volcanoes and cinder cones. In the southern part of the Tableland, in the region of the upper Tully River, little basalt has remained, so the land is more deeply incised and hilly.

An area called the Herberton Highland ajoins the Atherton Tableland and is more rugged and considerably higher with peaks nearing 4000 feet in the vicinity of Millaa Millaa.

Between the Atherton Tableland and the alluvial flats of the coastal plains, an area of deeply incised valleys, steep mountain sides and narrow spurs occurs. The highest points are Mt. Bartle Frere and Bellenden Kerr, both about 5250 feet and the tallest mountains in Queensland. This narrow zone represents the transition from tableland to coastal plain, and is occupied by granite massifs which being more wear-resistant than the surrounding Barron River metamorphics has caused differential erosion, to create valleys on each side of the granites.

The Atherton Basalt Province is the largest area of basalt in the Hodgkinson Basin and covers an area about 2000 square kilometres. The province extends from Mareeba south to the Tully River and east to Innisfail, and contains flows and pyroclastic deposits covering about 700 square miles. The buried flows in the alluviated plains of the Herbert River south of Mt. Garnet, may represent a link between the McBride, Einasleigh and Atherton Provinces. Most of the basalts occur in the northern part of the Atherton Tableland but some flows descend down the valleys toward the coastal plain. The remnants of a basalt flow 8 miles north of Atherton, are separated from Atherton Basalts by a range of hills.

The Atherton Basalts yield a rich brown soil. The basalt is readily weathered in the wet tropical climate of the coastal belt, but in the dry climate prevailing in the McBride Province, the basalt plains are very rough and stony.

About 50 vents have been recognized in the field or in aerial photographs. These include shield volcanoes ( broad and flat), composite volcanoes (layered ash and lava), cinder cones (ash) and one diatreme. Most of the lava vents are concentrated in the south and west of the province and the cinder cones to the north, where as the maars ( crater lakes) occupy a central belt. In several localities the topography and distribution of the basalts indicate the presence of eroded centres of eruption, as for example south-east of Ravenshoe.

The volcanic rocks include lava flows and coarse and fine-grained pyroclastic deposits (rocks forcibly ejected in a molten state through the air). On the Atherton Tableland the volcanics are deeply weathered and it is difficult to distinguish between flows and pyroclastics.

Columnar jointing is very common and good exposures can be observed in the many water-falls, e.g. Millaa Millaa Falls.

The pyroclastics deposits range from course to fine-grained, and are generally crudely bedded. Around the cinder cones the material tends to be purely volcanic, but around the maars the deposits contain a proportion of country rock derived from the explosion vents. The deposits around the maars are commonly composed of beds and layers less than one centimetre, rich in volcanics, alternating with layers mainly composed of sedimentary fragments.

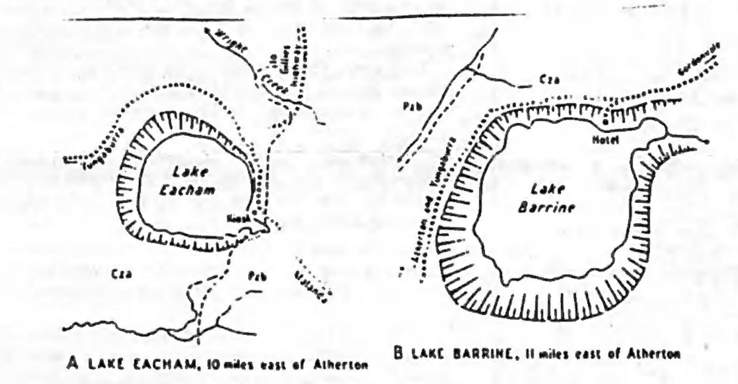
The cinder deposits consist of fragments of porous scoria and lapilli ( small bits 4 to 30 mm in size). Bombs and nodules are common in some deposits, e.g. Mt. Quincan and Gillies Crater. The basalts are under-lain in several places by Tertiary Sediments.

Although most of the basalt has been erupted from shield volcanoes they are not always obvious as they have slopes of less than 10°. They are probably the oldest eruption centures as they are relatively deeply eroded. Some have adventine explosion craters on their flanks.

Bones Knob, four miles north-west of Atherton, is probably the oldest vent in the Atherton Province having been active several times and the original crater now filled with fine-grained pyroclastics.

The cinder cones, or scoria cones, are steep sided cones built up mainly of a fine fountain of pyroclastic material. Scoria is Pyroplastic material that has cavities in it caused by escaping steam whilst the material was flung through the air. In the declining stages of a cycle of volcanic activity many of the cinder cones grade into composite cones. The cinder cones are the most conspicious volcanic forms in North Queensland.

Mt. Quincan is one of the best examples and is about 600 feet high. It has a crater about half a mile wide, and 300 feet deep below the top of the cone. The height of the rim on the north-west side is almost 200 feet higher than the south-east flank. This is due to the prevailing south-east winds and is a common feature of cones in North Queensland. The outer slope of Mt. Quincan is about 30° and the inner slope 45°. The floor of the crater has a small lake.




Examples of maars and crater lakes on the Atherton Tableland.

The Seven Sisters form a conspicious group of scoria cones (or cinder cones) 150 to 250 feet high, near Atherton. The outer slopes are about 30°. Deep craters are not found on the Sisters. The cross cutting bedding relationships indicate shifting of the explosive channels and small settling faults are also present.

Green Hill, of which more later, is a grass covered cone 350 feet high 8 miles south of Cairns. It is composed of basaltic tuff, fine grained pyroclastics and scoriaceous basalt bombs.

Maars are explosion craters from which only very small amounts of pyroclastic material were ejected, which may form low ring walls around the crater. The pyroclastics may commonly contain a considerable proportion of country rock, and where weathering is intense, the volcanic nature of the deposits can be inferred only from the red/brown colour of the soil, even when the only recognizable soil particles consist of slate, schist or granite. In such areas, the boundaries between the basalt and country rock can only be mapped approximately. Many of the maars contain a crater lake, but where the ring wall has been breachd by erosion, a swamp is generally all that remains e. g. Bromfield Swamp. Where the breached maars are covered by tropical rain forest they are difficult to detect on the ground, but are recognizable in aerial photos as circular flat-bottomed deposits e. g. Gillies Crater.

Where the amount of material ejected becomes large the maars grade into cinder cones.

Lake Barrine and Lake Eacham are the best known crater lakes in North Queensland. Lake Barrine is a maar with a diameter of about 1300 yards. It has a small enbayment which is possibly a smaller, secondary vent. The lake has been measured at 400 feet deep. The retaining ring wall is 90 feet above the surface of the lake and consists of beds of course and fine-grained pyroclastics mixed with a country rock including pieces of mica schist up to 2 feet across. The outside slope is about 15° away from the crater.

Lake Eacham has a diameter of about 1000 yards with a smaller embayment on the south-east side. Estimates of depth vary from 226 feet to 360 feet and 500 feet, but even the smallest figure makes it quite deep. The ring wall is 100 feet high and consists of pyroclastic beds dipping at 15° away from the crater.

Lake Euramoo, about six miles north of Lake Barrine consists of two small over-lapping craters. It is about 500 yards long and 150 yards wide with walls up to 90 feet high.

Bromfield Swamp, four miles south-west of Malanda, now cleared for dairy farming, is the largest maar in North Queensland, and has a diameter of about one mile. The crater is breached, and the lake has been reduced to a swamp. The crater is 150 to 200 feet deep - and about one-third the depth of Lake Barrine (500 feet). So little material has been ejected that there is barely a ring wall at all. The weathered basalt surrounding the crater has probably extruded from the big eroded and unobtrusive shield volcano whose apex lies four and a half miles south-west, Bromfield Swamp is probably an adventine explosion vent on the north- eastern flank of the shield volcano.

Lynch's Crater, six miles east of Malanda, is another breached crater without a real ring wall. It is about 150 feet deep, has a diameter of 700 yards, and slopes inward at 25°. Among the ejected bombs and fragments are boulders of schist up to a foot long.

The name Gillies crater has been given to a breached maar on the southern side of the Gillies Highway near Heales Lookout, ten miles south-west of Gordonvale. The pyroclastic rocks are exposed along the highway and in a road metal quarry. They consist of unconsolidated layers of well bedded ash, and contain bombs and fragments of peridotite, olivine basalt, slate, schist and Barron River metamorphics. The beds dip at 15° to 20° away from the crater, which is a circular depression about 600 yards wide covered with vegatation. The exposures along the highway show the nonconformity with the underlying granitic bedrock, and the alternation of fine-grained and course-grained beds of pyroclastics, including a nine foot layer of red/brown to ochre-coloured tuff ( compacted fragments of less than 4 mm).

Hypipamee Crater in the Atherton Province, at an altitude of approx 1040 yards is the only known example of an explosion pipe or diatreme, where there is almost no erupted material. The explosive force of hot gases has blown out a vent pipe through the Elizabeth Creek granite to make a sheer-sided hole about 87 yards wide and 153 yards deep, now partly filled with water to a depth of 83 yards. The formation would seem to have been created in a single event.

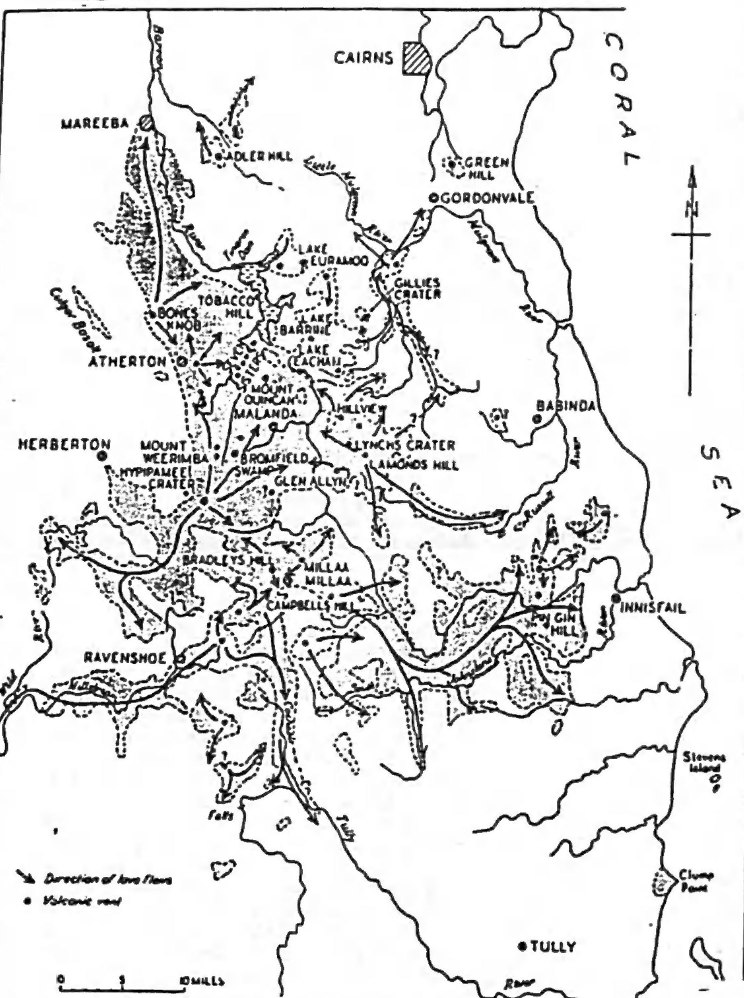



Fig. 16. The Atherton Basalt province.

The age of the Atherton basalts would seem to be MIOCENE to recent, that is about four million years.

One last thing about Green Hill near Gordonvale: this cone has had a significant effect on the Cairns city area. Once, the Mulgrave River went out to sea at Trinity Inlet, forming the delta and flat plain we now utilize. The emergence of Green Hill caused the Mulgrave River to change direction and to flow out to sea at Russell Heads. The much reduced flow of water in Trinity Bay would have seen a big impact on siltation.

But Green Hill did not do this on its own. There is a sheer zone,or Axis of Warping, that extends from an area 25miles from Cooktown to west of Mareeba and further south to Ganawarra and beyond. Warping along this zone, together with several other volcanoes, has caused the rearrangements of most of the rivers on our coast, including diverting the Russell from Innisfail.

In general, the vulcanism in the Atherton Province evolved from an initial lava rich stage to an increasingly explosive gas-rich stage, with few flows. The centres of activity shifted gradually from the south- west to the north-west, and Mt. Quincan, the Seven Sisters, the crater lakes, and Green Hill probably represent the latest eruptions.

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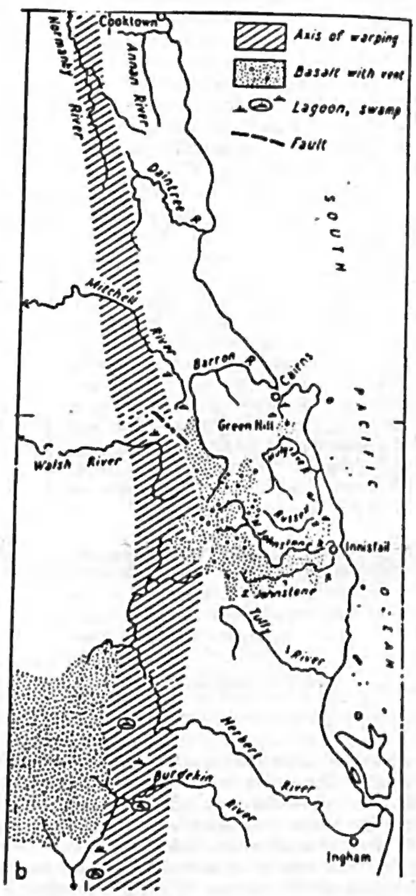


The World Congress of Herpetology announces the

## FIRST WORLD CONGRESS OF HERPETOLOGY

11–19 September 1989
at the University of Kent, Canterbury (U.K.)

This international congress will be the first of a series occurring at regular intervals at venues around the world. Such a meeting will enable all persons interested in herpetology to meet and exchange information to promote the advance of knowledge and the conservation of the world's amphibians and reptiles. The congress will consist of topical symposia, poster sessions, plenary speakers, workshops, displays, excursions, and meetings of ancillary groups. Subjects and moderators of symposia will be announced well in advance so that potential participants can volunteer. The meeting will be open to all persons. Registration will begin 1 January 1988.

**For further details and mail listing, write: Dr. Ian R. Swingland, World Congress of Herpetology, Rutherford College, University of Kent, Canterbury, Kent CT2 7NX, United Kingdom.**

**Sponsoring organizations and individuals are welcome. For further details write: Dr. Marinus S. Hoogmoed, Rijksmuseum van Natuurlijke Historie, Postbus 9517, 2300 RA Leiden, The Netherlands.**

## NATS CLUB CAMPOUT 1986

By Dawn and Arnold Magarry

With a public holiday falling on Friday 17th, and making a long weekend, twenty four members and friends of the North Queensland Naturalists Club took the opportunity to visit Blencoe Falls. The Falls are situated on Blencoe Creek which runs into the upper reaches of the Herbert River.

Campers left Cairns early on Friday and travelled via Mt. Garnet and Gunnawarra Station, most of the vehicles catching up with each other where the road crossed the Herbert River. Here lunch was enjoyed under the shade of red flowering Melaleucas, while the calls of Brown and Scarlet Honeyeaters filled the air. The white flowered Grevillea parallela was plentiful along the way and some of the birds sighted were the Bustard, Emu, Squatter Pidgeons, Pale Headed Rosella, Noisy Miner, Blue Winged Kookaburras and Brown Falcon. Some of the water birds seen by folk who visited the Minnamoolka Swamp were Magpie Geese, Brolgas, Glossy, Sacred and Straw Necked Ibis, White Necked Heron, Black Swans, Marsh Harrier, and Various ducks and cormorants..

Continuing the journey we crossed a short range before reaching Blencoe Creek. The surrounding country was open woodland with the dominant trees eucalypts and ironbarks with melaleucas and casuarinas along the rocky creek. A large flat area suitable for camping was found upstream from the bridge, and by 4p.m. everyone was settled, water carted and campfire site cleared. Some hardy folk braved the cool water for a swim, assuring the faint hearted among us that it was lovely once you got in.

Campers were astir not long after daybreak,a few people taking an early walk before breakfast where several parties of Red Backed Wrens were seen and a pair of unidentified Quail flushed. By 9a.m. all were ready for a walk to the head of the Falls, a distance of about 1½kms. The track followed the creek most of the way. White Throated, Yellow Faced, Lewin and Scarlet Honeyeaters were busy among the Melaleucas along the creek, and the nesting holes of several Striated Pardalotes were observed in the banks of the road cuttings. A Brown Honeyeater was found nesting.

Blue Bells ( Wahlenbergia) and Billy Buttons ( Craspedia unifloria) were flowering along the way and hundreds of Black Boys ( Xanthorrhoea) were beginning to shoot up their "spears". Pandanus, Pittosporum and Quinine Bush ( Petalostigma triloculare) all had fruit in evidence. Some odd shaped insect galls were noted on many of the smaller eucalypts and the only butterflies seen were Glasswings and small Grass Yellows. A beautifully marked skink of the Ctenotus family was found under a rock.

Water rushing over the Falls made spectacular viewing from a rocky vantage point. Everyone was thrilled to watch the aerobatics of three large Wedge-tailed Eagles over the gorge below. On the steep cliff opposite the flower spikes of the Rock Orchid ( Dendrobium speciosum)could be seen with binoculars. On the ridges, close to and below the Falls were stands of Hoop Pine ( Araucaria cunninghamii).

After a leisurely lunch and time spent identifying botanical specimens, cars ferried folk about 5 kilometres to the opposite side of the gorge where an even better view of the Falls could be seen as they tumbled in several drops to the creek below. A little further down-stream could be seen the junction of Blencoe Creek with the Herbert River.

Following the evening meal, campers gathered for a relaxing chat by the campfire. During the night the eerie calls of the B sh Stone Curlews could be heard in the distance.

Next day some campers headed off early for home while others enjoyed another walk and swim in the creek, but by lunch all tents had been folded, the camp area tidied and the bush silent again save for the calls of the birds and the river murmering in its rocky bed.

The return trip was made down the rainforested slopes of the Kirrama Range to Kennedy and thence along the coast to Cairns.

Trees identified in the camp area were -

E. platyphylla ( Poplar Gum )
E. alba ( also known as Poplar Gum, White Gum and one of the Red Gum family )
E. shirlyi ( Iron Bark )
E. drepanophylla ( Queensland Grey Ironbark )
E. trachyphylla ( Woody Fruited Bloodwood )
E. phaiotricha ( White Stringbark)
E. abergiana ( Range Bloodwood )
Tristania conferta ( Brush Box )
" suaveolens
Callistemon viminalis ( now known as Melaleuca viminalis ) ( Weeping Bottle Brush)
Grevillea pteridiifolia ( Golden Parrot Tree)



Bird list for the camp area.

Scarlet Honeyeater
Brown "
Yellow Faced "
Lewin "
Blue Faced "
White Throated "
Yellow Tinted "
Striated Pardalotte
Red Browed Firetail
Willie Wagtail
Welcome Swallow
Fan Tailed Cuckoo
Bush Stone Curlew
Little Cuckoo Shrike
Noisy Friarbird
Brush Cuckoo
Wedge-tailed Eagle
Peregrine Falcon

Little Lorikeet
Magpie
Lemon Breasted Flycatcher
White Faced Heron
White Throated Warbler
Rufous Whistler
Weebill
Varied Sitella
Black Faced Cuckoo Shrike
Red Backed Wrens
Grey Fantail
Rainbow Lorikeet
Leaden Flycatcher
Grey Thrush
Torresian Crow
Pied Currawong
Pale Headed Rosella
Peaceful Dove

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## EXPLORING GREEN ISLAND

By Sybil Kimmins

On March 9, 18 members of the Naturalist's Club went on an outing by launch to Green Island. Discovered by Captain Cook in 1770, and named in honour of Mr. Charles Green, astronomer to the Endeavour party. This coral atoll is situated about 27km. from Cairns.

Despite the island's popularity as a tourist resort, members found the flora and fauna is still largely unspoiled. Following walking tracks through the forest, we saw many species of trees including the silvery-leaved shapely Tournefortia argentea, scaly ash ( a Meliaceae), red coondoo Sapotaceae mimusops, Pisonia, white cedar Melia azederach, Glycosmis ( a rutaceae) and an uncommon palm, Argena. The orange trumpet shaped flowers of Cordia subcordata were scattered on the ground.

The quaint arrowroot plant Tacca pinnatifida,grew freely on the edge of the forest.

A huntsman spiders's egg sac was found on the ground and a Whimbrel was glimsed walking on the leaf litter.

On the exposed south-eastern side of the island, lumps of sticky jelly-like substance were on the sand. This could have been Cyanea capillata. Also on this side lay a huge log with OFAE SUVE 5171 and other marking on it. This log is known to have been washed up on the sand some years ago.

Near the beach, a Horsfield Bronze Cuckoo was seen with its irridescent copper-green coat shining in the sunshine. An Emerald Dove was another enjoyable sighting. Among other birds seen were a number of Grey Reef Herons, White Reef Herons, a Crested Tern and a flock of Pale Silvereyes.

On the coral sand above the high tide mark the mauve flowers of the tough vine Ipomoea pes-caprae provided contrast to the graceful Casuarina equisetifolia trees that clung stubbornly to life despite the predations of the sea.

People who swam in the shallows noticed a lot of sea grase Thuarea involuta. Here, fish were being fed with bread by a few visitors.

After lunch saw people setting out on their reef walk. Various corals including the staghorn coral Acropora were seen. Four species beche de mer Holothuria including Atra. A triton shell Charonia tritonis and other strange denizens of the reef.

Snorkellers Ann and Jim Downey had a wonderful time down among the living corals and fish, while the birdwatchers enjoyed a variety of sightings on the shoreline.

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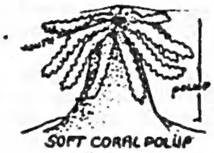
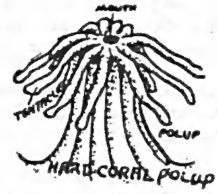
Snorkellers, Anne and Jim Downey had a wonderful time down among the living corals and fish,while the birdwatchers enjoyed a variety of sightings on the shoreline.

## GREEN ISLAND - LIST OF FISH

By Jim and Anne

Moorish Idol
Blue-spotted Stingray
Giant Trevally
Yellow Damsel
Wire Netting Rock Cod
Six-banded Anglefish
Parrot Fish
Trumpet Fish
Burrowing Clams



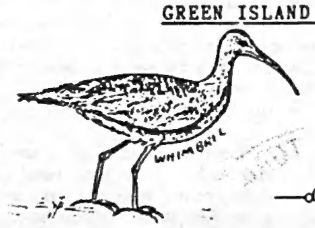




Fusilier
Starfish
Sea Urchin
Soft Coral Polyps
Hard Coral Polyps
Sea Cucumber
Potato Cod
Butterfly Fish

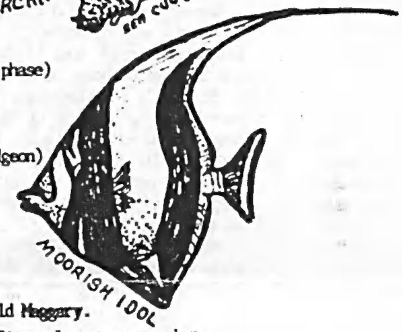


## GREEN ISLAND - BIRD LIST

Crested Tern
Lesser Crested Tern
Brown Booby
Black Naped Tern
Common Noddy
Silver Gull
Turnstone
Whimbrel




Reef Heron( grey and white phase)
Welcome Swallow
Silvereyes
Sparrow
Emerald Dove (Greenwing Pidgeon)
Horsfield Bronze Cuckoo
Sunbird

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## CLUB OUTINGS 1987.

By Dawn and Arnald Magarry.

During January a small party of club members travelled to the Mt. Carbine area to camp on the banks of the Mitchell River close to a popular local swimming spot,called ' The Big Hole.'

Mt. Carbine is a small mining community situated some 130kms. by road from Cairns, and almost due west from the coastal town of Mossman. The country-side was very dry, rain generated in the high ranges behind Mossman generally falls on the seaward side, though there was a slight fresh in the river on the second night due to rain in the Mt. Lewis area.

The Mitchell River,though it rises in the East coast ranges, has a vast network of tributaries which combine to flow west and empty a vast quantity of water into the Gulf of Carpentaria during the wet season.

The temperature during the day reached 33 degrees celsius, so activity was mostly early morning and late afternoon with the intervening hours spent cooling off in the river.

Along the river and on sandy banks midstream the dominant tree was Melaleuca leucadendron. Other trees identified included Pandanus, Barringtonia acutangula with its long drooping sprays of red flowers, large leafed Leichhardt Tree (Nauclea orientalis), Eucalyptus alba,E. camaldulensis, and Tristania exiliflora.

Large areas on the flats beside the river were covered with the pest Cryptostegia grandiflora,commonly called Rubber Vine,making access to the water difficult.

Most birdlife was confined to the vegetation along the river, though a first light walk into the neighbouring Ironbark and Eucalypt scrub produced Grey Crowned Babblers, Weebills, Pied Butcherbird, Little Friarbird and Torresian Crow.

Four species of Cuckoo were recorded— Brush, Channel Billed, Rufous Breasted Bronze and Koels which were very vocal. Honeyeaters included Blue Faced, Brown, Yellow, White Throated and the Noisy Friarbird. A pair of Brown Backed Honeyeaters was observed building a nest in overhanging Melaleuca foliage.

Both Kookaburras were present, Laughing and Blue Winged, which called quite late after dusk. A pair of Black Bitterns was flushed from the thick Leichhardt Trees and flew along the river to land in the Melaleucas and climb nimbly out of sight.

A magnificent Osprey sat on a prominent dead tree overlooking 'The Big Hole'. Usually a bird of the coast, they are often found over large inland water courses and lagoons. A small flock of Red Tailed Black Cockatoos slowly winged their way upstream during the second day. Just on dusk each evening a lone Brush Turkey picked its way along the bank opposite the camp site.

Pale Headed Rosellas and Red Winged Parrots fed on the ripe fruit of the Leichhardt Trees while a pair of bright jewels, Azure Kingfishers, fished regularly up and down the banks.

Other birds listed were White Faced Heron, Kestrel, Black Kite, Australian Goshawk, Peaceful Dove, Bar Shouldered Dove, Rainbow Lorikeet, Grey Swiftlets, Sacred and Forest Kingfishers, Rainbow Bee-eater, Little and Black Faced Cuckoo Shrikes, Cicada Bird, Leaden Flycatcher, Fairy Warbler, Little Friarbird, Striated Pardalote, Mistletoe Bird, Olive Backed Oriole, Drongo, Great Bowerbird and Pied Currawong.

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North Queensland Naturalists Club

Activities for 1987

| | | | |
|---|---|---|---|
| April | 8 Wed. | Committee | Joan Chapman 66 Walsh St., Edge Hill |
| | 12 Sun. | Outing | Double Island - Boat Trip |
| | 14 Tues. | Meeting | |
| | 17 to 20 | Easter w/end - | Bird watching at Georgetown; contact D. Magarry |
| May | 2 to 4 | May Day w/end - | Mt. Mulligan |
| | 6 Wed. | Committee | Andrew Krumins, 24 Panguna St., Smithfield Hts. |
| | 10 Sun. | Outing | Crystal Cascades and Mc Gregor Rd., Smithfield. |
| | 12 Tues. | Meeting | |
| Jun | 3 Wed. | Committee | Sybil Kimmins, 231 Lyons St., Westcort |
| | 6 to 8 | Queens B/day w/end- | Cardwell and Mt. Leach Range |
| | 9 Tues. | Meeting | |

Meetings are held at the Education Centre, corner of Morehead and Lazarus Streets, Bungalow, commencing at 8pm.

Usual assembly point for outings is the Cairns City Library, 7.30 am.

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